

## II.9 Ground Equipment for “Hot-Spot” Treatments With Chemical Sprays

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Aerial application of ultra-low-volume (ULV) malathion at 8 oz/acre has proven to be a very successful method of controlling grasshoppers in the United States and other parts of the world. Using aircraft is the most efficient way to treat large infestations.

In the integrated pest management (IPM) mode, program managers often strive to reduce grasshopper numbers on small areas to lessen the chances of spread of the infestation or to protect valuable forage and crops. In much of the Western United States, aircraft simply are not available or are far too expensive to treat small infestations (up to 1,000 acres). Ground application or no control are the only options. Conventional row-crop sprayers with booms are not sturdy enough for treating rangeland and are not adapted to volumes in the ULV range for malathion.

In an IPM program to control range caterpillar in New Mexico, ( a wind-assisted dispersal system for “hot-spot” treatment with ground equipment was successfully developed. This approach is used on thousands of acres each year. New Mexico State University has adapted this approach to rangeland grasshopper control and also found it to be very successful for black grassbug control in New Mexico.

### Equipment

We conducted experiments in western New Mexico in late May–early June 1986, on predominantly blue gramma grass rangeland. The principal grasshoppers were *Aulocara elliotti* (bigheaded grasshopper) and *Melanoplus sanguinipes* (migratory grasshopper), and most were adults at the time of spraying. The experiments included a completely random design with a minimum of five replicates per treatment. Square 40-acre plots were treated using a swath spacing of 100 ft.

A mist blower (Model MM55-S, Automatic Equipment Mfg. Co., Pender, NE) was mounted in a trailer pulled behind a half-ton pickup truck. A motorized backpack mist blower (Solo Port 423, Solo Inc., Newport News, VA) was mounted in the back of the truck. The truck was driven at 10 miles per hour (mi/hour) perpendicular to the prevailing wind with both sprayers calibrated to deliver 8 oz/acre of ULV malathion. Grasshopper density was checked 1 day prior to treatment and 1 day after

treatment. We counted densities in 40 0.1-m<sup>2</sup> rings in a circle 165 ft in diameter in the center of each plot. Mortality was estimated from pre- and posttreatment counts.

### Control

The MM55-S mist blower provided excellent control when used in windspeeds of 4 to 20 mi/hour. For six replications of the test, the average grasshopper mortality was 93 percent with a range of 87 to 100 percent. Two additional replicates evaluated adverse conditions in which effectiveness was greatly reduced (64 percent compared with 93 percent) when this piece of equipment was used with 100-ft swaths in light and variable winds. The Solo 423 was found to provide 95-percent control (range 91 to 100 percent) when used at windspeeds in excess of 5 mi/hour. The results of a single trial were similar to those for the MM55-S mist blower in light and variable winds.

### Using the Equipment in the Field

Results showed that both the MM55-S and the Solo 423 mist blowers delivered ULV malathion at the same volume per acre as aircraft and provided control at least equal to that of malathion delivered from aircraft. Both pieces of equipment were equally effective, and both require a steady, fairly strong wind to be effective.

ULV malathion is available in 5-gal containers at a 1994 cost of about \$24/gal (Helena Chemical Co., Terra Int.). At 8 oz/acre, the chemical cost is \$1.50/acre. Because no mixing is required, unused material can be stored in the original container and should have a shelf life of at least 2 years if stored properly.

Using a 100-ft swath and 10 mi/hour vehicle speed, mist sprayers can cover 2 acres/min. Counting lost time turning, coverage of 80–100 acres/hour is possible. The MM55-S has a cab-mounted remote control that changes the spray from right to left, so whenever the driver turns, he or she can direct the spray downwind. A device to attach the Solo 423 to the tailgate and ropes and pulleys to change the direction of the spray should be easy to build. One rancher in New Mexico has a mist blower that is similar to the MM55-S but does not have a remote control to switch the spray directions. He simply drives forward on one swath and backs up on the next.

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Calibration of a sprayer is simply making sure that the sprayer is delivering the correct amount of spray per acre. For the example used here (100-ft swath and 10 mi/h), the sprayer will cover 2 acres/min.

Here's how that figure was calculated:

$10 \text{ mi/hour} = 52,800 \text{ ft/hour} \div 60 = 880 \text{ ft/minute} \times 100\text{-ft swath} = 88,000 \text{ ft}^2/\text{minute}.$

$88,000 \div 43,560 \text{ ft}^2 \text{ in an acre} = 2.02 \text{ acres/minute}.$

$2 \text{ acres/minute} \times 8 \text{ oz/acre} = 16 \text{ oz/minute} = 1 \text{ pt/minute}.$

Solo does sell a ULV attachment for the Solo Port 423. Instead, a metering orifice or flow regulator can be inserted in the plastic line between the tank and the nozzle. These orifices and accessories are available from suppliers of agricultural sprayer parts. The larger mist blowers use a pump and pressure regulator, which may be adequate. If not, use a metering orifice.

ULV malathion flows enough like water that water can be used for the initial calibration. For the Solo, pour 3 gal of water in the tank and make sure the supply hose is full. Run the sprayer for 2 minutes and measure the amount of water left, including that in the supply tube. This calibration normally will use 1 qt. You may need a larger or smaller orifice to get the desired rate. For the mist blowers with pumps, you can use a similar procedure or you can catch the output from the nozzle without the fan blowing. Changing the pressure and/or the metering orifice will change the flow rate. During spraying operations, applicators should check the flow rate of the ULV malathion and make required adjustments.

Mist blowers are an effective way to control grasshoppers on rangeland with ground equipment. We prefer the relatively inexpensive motorized backpack mist blower because of cost and versatility. Users can adapt the blower to all-terrain vehicles, and a mist blower is handy for spraying trees and small gardens.